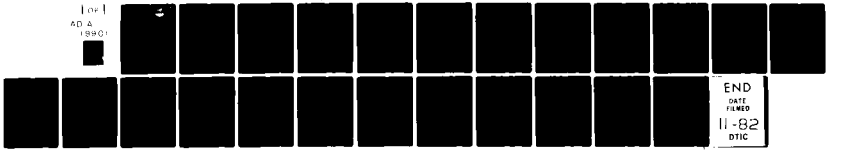
AD-A119 901 AIR FORCE OCCUPATIONAL AND ENVIRONMENTAL HEALTH LAB --ETC F/G 11/2
ISOCYANATE MONITORING USING N-P-NITROBENZYL-N-PROPYLAMINE GLASS--ETC(U)
AUG 82 K A CARSON
UNCLASSIFIED OEHL-82-022EH163HAE NL



USAF OEHL REPORT
82-Ø22-EH163HAE

ISOCYANATE MONITORING USING N-P-NITROBENZYL-N-PROPYLAMINE GLASS FIBER SAMPLING TUBE

AUGUST 1982

Approved for public release; distribution unlimited

USAF Occupational and Environmental Health Laboratory
Aerospace Medical Division (AFSC)
Brooks Air Force Base, Texas 78235

NOTICES

When U.S. Government drawings, specifications, or other data are used for any purpose other than a definitely related Government procurement operation, the Government thereby incurs no responsibility nor any obligation whatsoever, and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication or otherwise, as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

The mention of trade names or commercial products in this publication is for illustration purposes and does not constitute endorsement or recommendation for use by the United States Air Force.

Do not return this copy. Retain or destroy.

Please do not request copies of this report from the USAF Occupational and Environmental Health Laboratory. Additional copies may be purchased from:

National Technical Information Service
5285 Port Royal Road
Springfield, Virginia 22161

Government agencies and their contractors registered with the DTIC should direct requests for copies of this report to:

Defense Technical Information Center (DTIC)
Cameron Station
Alexandria, Virginia 22314

This report has been reviewed by the Public Affairs Office and is releasable to the National Technical Information Service (NTIS). At NTIS, it will be available to the general public, including foreign nations.

This technical report has been reviewed and is approved for publication.

William E Mabson

WILLIAM E. MABSON, Colonel, USAF, BSC
Commander

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER USAF OEHL Report 82-022EH163HAE	2. GOVT ACCESSION NO. AD-A119901	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* Isocyanate Monitoring Using N-p-nitrobenzyl-N-propylamine Glass Fiber Sampling Tube		5. TYPE OF REPORT & PERIOD COVERED Final - Jan-Apr 1982 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) 2Lt Kathleen A. Carson		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS USAF Occupational and Environmental Health Laboratory, Brooks Air Force Base, Texas 78235		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS USAF Occupational and Environmental Health Laboratory, Brooks Air Force Base, Texas 78235		12. REPORT DATE August 1982 13. NUMBER OF PAGES 18
14. MONITORING AGENCY NAME & ADDRESS*(if different from Controlling Office)*		15. SECURITY CLASS. *(of this report)* Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*

Approved for public release, unlimited distribution

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Isocyanate
HDI, MDI, TDI,
Spray painting
Foam-in-place

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

N-p-nitrobenzyl-N-propylamine glass fiber sampling tubes were evaluated in the field for detection of HDI during aircraft spray painting and MDI during foam-in-place operations. The tubes, prepared and analyzed according to NIOSH Method P&CAM 326, were satisfactory for HDI monitoring during spray painting, but were inadequate for MDI monitoring under the conditions of the survey.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT NO. 82-022EH163HAE

Isocyanate Monitoring Using N-p-nitrobenzyl-N-propylamine Glass Fiber Sampling Tube

August 1982

Prepared by:

Kathleen A. Carson

KATHLEEN A. CARSON, 2Lt, USAF, BSC
Bioenvironmental Engineer

Reviewed by:

Jimmy D. Langwell

JIMMY D. LANGWELL
Consultant, Industrial Hygiene

Approved by:

Johan E Bayer

JOHAN E. BAYER, Colonel, USAF, BSC
Vice Commander

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

I. INTRODUCTION

Isocyanates are widely used in the Air Force as components in coatings, varnishes, foams, and adhesives. The basic chemical structure of an isocyanate is:

$$R - N = C = O$$

where R represents some aromatic or aliphatic group. The primary aromatic isocyanates used in the Air Force are toluene diisocyanate (TDI), used to form flexible foams, and diphenyl methane diisocyanate (MDI), which forms rigid foams. Hexamethylene diisocyanate (HDI), an aliphatic isocyanate, is a component in polyurethane paints. Exposure to isocyanates can cause allergic sensitization in susceptible individuals, aggravation of existing respiratory problems, a decrease in respiratory capacity, and irritation of the skin and mucous membranes of the eyes and respiratory tract.

Colorimetric procedures for detecting aromatic isocyanates have existed since they were first widely used in the early 1950s. However, analytical procedures for detecting aliphatic isocyanates have not been available until relatively recently. In 1980, in Volume 6 of its Manual of Analytical Methods, NIOSH published a chromatographic method which can detect both aromatic and aliphatic isocyanates. In December 1981, the USAF Occupational and Environmental Health Laboratory (USAF OEHL) initiated trial use of the method at base level. The primary task of the USAF OEHL Industrial Hygiene Branch was to provide a field evaluation of the method for HDI-sampling during aircraft spray painting operations. A secondary objective was to field test the method for TDI/MDI sampling during foam operations. The following report details the procedures and results of the field evaluation.

II. BACKGROUND

The isocyanate method tested by the USAF OEHL is a variation of NIOSH Method No. P&CAM 326, which is based upon the chromatographic method of Vogt, Ko, and Ryan (9). In this method, N-p-nitrobenzyl-N-propylamine, otherwise known as nitro reagent, is coated on fibrous glass wool which is then placed inside a shortened section of Pasteur pipette. When air is drawn through this sampling tube, the isocyanate reacts with the nitro reagent to form the urea derivative of the isocyanate. The urea derivative of the isocyanate is then eluted from the glass fiber in the laboratory and detected using High Performance Liquid Chromatography (HPLC).

In two previous aircraft spray paint surveys for HDI, the USAF OEHL used an earlier NIOSH method, No. 240, in which the same chemical reaction occurs in a toluene/nitro solution in an impinger (2,6). Prior to these surveys, the USAF OEHL also performed two HDI surveys using the DuPont method (1,3). The DuPont method is a colorimetric procedure using a midget impinger containing a dimethyl sulfoxide-hydrochloric acid absorbing solution. Neither of these impinger methods is satisfactory for routine sampling at the base level.

However, sampling for TDI and MDI has been possible at base level using the Bendix Air Analysis Kit and the MDA 7005 tape monitor. The Bendix sampling method is a semiquantitative variation of the Marcali method. This colorimetric method, which is specific for aromatic isocyanates, also requires

impingers and is subject to negative interference by tertiary amines. The MDA 7005 tape monitor detects and measures the change in optical density which occurs when TDI or MDI react with a chemically impregnated paper strip. NIOSH recommends the tape monitor as a valuable method for continuous monitoring of aromatic isocyanates, particularly TDI (7).

The glass fiber method tested by the USAF OEHL would be suitable after validation for routine, base-level monitoring of both aromatic and aliphatic isocyanates, and would eliminate the need for impingers and costly monitoring equipment. Analysis by HPLC allows detection of TDI, MDI, and HDI monomers, and HDI biuret trimer. NIOSH classifies this method as a Class D method, which is one generally accepted by industrial hygiene analysts, although not completely evaluated by anyone. NIOSH has tested Method P&CAM 326 in the laboratory for TDI vapor using nitro-coated glass fiber sampling tubes and for MDI aerosol using nitro-coated 13 mm glass fiber filters (8).

III. SAMPLING PROCEDURES

A. Aircraft Spray Painting

Sampling for HDI included three separate surveys performed at Hangar 48, an aircraft spray paint hangar at Randolph AFB, during complete and touch-up painting of T-37 and T-38 aircraft. The ventilation in the hangar was push-pull with two units delivering 80,000 cfm and three fans exhausting 71,000 cfm. The paint used was Deft Polyurethane Coating, NSN 8010-00-181-8281, MIL-C-83286B (Appendix 1). Paint was applied using a DeVilbiss, Size 30 (4-hole) air spray gun and pressure cup for touch-up painting, and a DeVilbiss, Size 78 (10-hole) air spray gun and pressure pot for complete painting.

For both complete and touch-up painting, application of the first coat required 30-45 minutes. Then after a 15-30 minute drying period, the second coat was applied. Unless otherwise indicated, sampling pumps operated continuously from the beginning of the application of the first coat through the application of the second coat. Other sampling conditions varied during each of the three surveys and are specified in Table I and in Section IV.

B. Foam-in-Place Operation

The USAF OEHL conducted one survey for MDI concentrations at a foam-in-place operation at Bldg 310, Kelly AFB. Local exhaust ventilation resulted in an air velocity of 150-165 fpm across the face of the application area. A Guzmur Model 630 unit mixed Universal Polymers Maxpak 454 components A and B to form the foam, which was applied to the packing boxes through a sprayless nozzle. Component A consisted of MDI monomer, higher polymers, Freon 11, and a trace amount of methylene chloride. Component B consisted of a high molecular weight polyalcohol, a tertiary amine catalyst, and Freon 11.

TABLE I. ISOCYANATE SURVEY CONDITIONS

Survey	Location	Isocyanate Sampled	Operation	Temperature °F	Humidity %
I	Hangar 48 Randolph AFB	HDI	Complete Painting T-37	84	40
II	Hangar 48 Randolph AFB	HDI	Complete Painting T-38	68	75
III	Hangar 48 Randolph AFB	HDI	Touch-up Painting T-38	69	76
IV	Bldg 310 Kelly AFB	MDI	Foam-in-Place Packing	68	72

C. General Protocol

The USAF OEHL developed the following general guidelines for field evaluation of the nitro-coated glass fiber method for HDI sampling during spray paint operations and for TDI and MDI sampling during foam operations.

1. Determine the limits of the method.

2. Screen for interferences.

3. Verify the stability of the reagents and the products of the reaction.

4. Estimate the sampling precision.

5. Estimate the accuracy of the method.

IV. DISCUSSION AND RESULTS

A. HDI Sampling During Aircraft Spray Painting

1. Limits

The sampling tube containing the nitro-coated glass fiber is used in the same way as the familiar charcoal tube, except a higher flow rate of 2.0 Lpm is required for the glass fiber sampling tube. Like the charcoal, the glass fiber is in the two sections, a 7 mm front sampling section and a 5 mm back section to detect breakthrough. NIOSH recommends sampling at least 60 liters of air to detect trace amounts of isocyanates as low as 0.02 micrograms. The data from the USAF OEHL surveys showed that breakthrough did not occur until the quantity of HDI detected exceeded 18 micrograms. These limits allow the detection of HDI levels ranging from 0.3 $\mu g/m^3$ to 300 $\mu g/m^3$ for a 60-

liter sample. For a 20 liter, 10 minute ceiling limit determination, levels ranging from 1 $\mu g/m^3$ to 900 $\mu g/m^3$ can be detected, or up to approximately six times the ceiling limit. The NIOSH recommended, 10-hour workshift, 40-hour workweek, TWA for HDI is 35 $\mu g/m^3$ and the recommended ceiling limit for any 10-minute period is 140 $\mu g/m^3$.

2. Stability

The NIOSH procedure cautions against possible interference during sampling. Nitro reagent on glass fiber is unstable in the presence of light and is unstable to a lesser extent during storage in the dark. The deterioration of the reagent results in a positive interference caused by the presence of a peak during HPLC, which coincides with the HDI-urea peak. To eliminate the possibility of this type of interference, tubes are prepared in the USAF OEHL analytical laboratory and delivered to the base by the next day for immediate use. Each tube is refrigerated before and after use and covered with aluminum foil to protect it from exposure to light. During the course of the surveys, the USAF OEHL analyzed tubes that had been refrigerated as long as five days before and five days after sampling with no indication of interference or deterioration. The NIOSH method recommends storage no longer than seven days at room temperature in the dark and four weeks at -21°C.

3. Chemical Interferences

Both positive and negative chemical interferences are also possible. Any chemical that will react with the isocyanate group can cause a negative interference; and any compound that has the same retention time during HPLC as the urea-derivative of the isocyanate can interfere positively. No interferences of either type were identified during the spray paint surveys.

4. Precision

Table II shows the HDI levels of five samples collected from the same area in the spray paint hangar at Randolph AFB. The average amount of HDI present was 19.58 μg with a standard deviation of $\pm$ 2.71 μg. The RSD is 14%. The calculated average concentration was 69 $\mu g/m^3$ with a standard deviation of $\pm$ 8 $\mu g/m^3$.

The samples, which were separated by no more than four feet, were located at Point A in Figure I. All the Survey III samples in Area A were collected for 140 minutes at 2 Lpm during touch-up painting of a T-38 aircraft. Although 60 liters is the recommended sampling volume for determining the TWA for HDI, higher volumes were used in this case to detect breakthrough and establish the limits of the method. Breakthrough did occur in two samples as shown in Table II. However, even at its limits, these data show the method to be reasonably precise.

TABLE II. HDI LEVELS FROM AREA A
(SURVEY III)

Sample	HDI, µg	HDI, µg/m³
1	17.52	62
2	23.79*	84
3	20.73*	73
4	17.39	62
5	18.48	66
Mean	19.58	69
Std. Dev.	2.71	8

*Breakthrough occurred. HDI levels are the sum of the front and back sections.

5. Accuracy

Although the accuracy of the method could not be directly determined under uncontrolled field conditions, the following sampling procedures were used to estimate accuracy:

a. Comparison of HDI Levels Sampled at 1 Lpm and 2 Lpm

There was no significant difference between HDI levels collected on single sampling tubes at 1 and 2 Lpm for the microgram quantities shown in Table III. The sampling tubes, as listed, were in consecutive order, in Area A (Figure I), with no more than 6 inches separating each tube; each sample was collected for 102 minutes.

TABLE III. COMPARISON OF HDI LEVELS AT 1 LPM AND 2 LPM
(SURVEY II)

Paired Sample Groups Area A	Rate, Lpm	HDI, µg	HDI, µg/m³
	1	4.905	48
	1	3.787	37
	2	10.006	49
	2	7.127	35

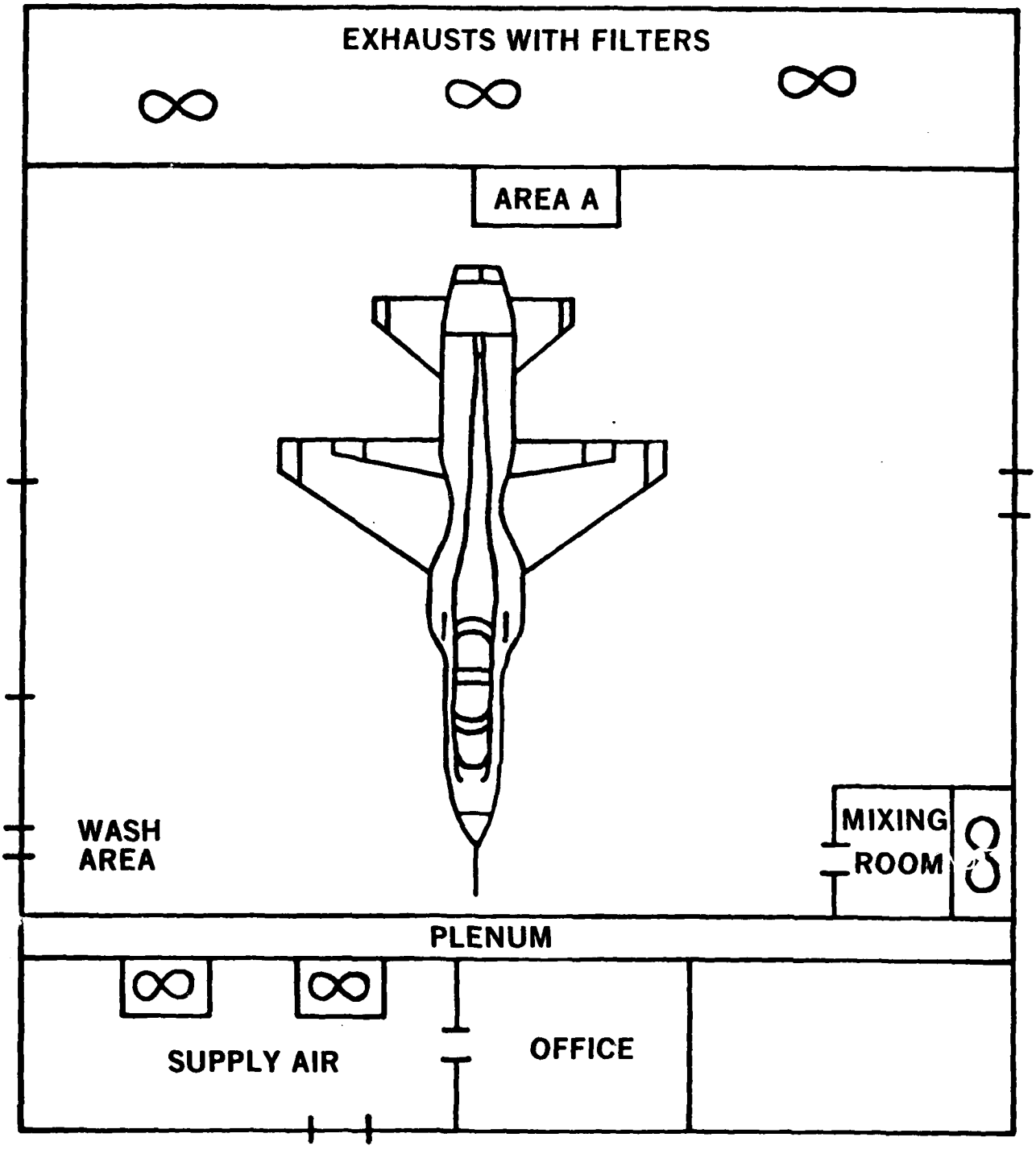


FIGURE I. SAMPLING AREA, SURVEYS II AND III HANGER 48, RANDOLPH AFB

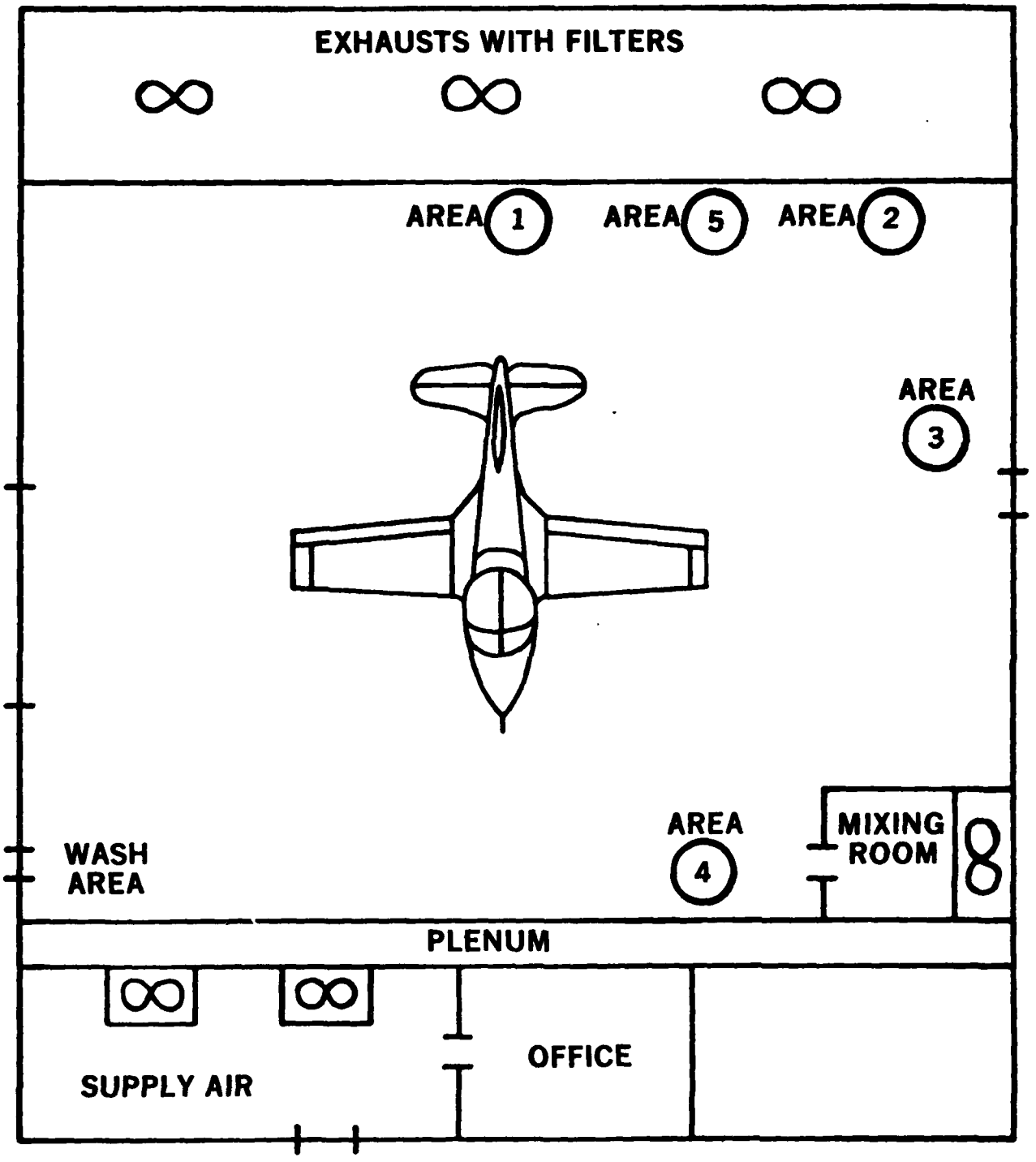


FIGURE II. SAMPLING AREAS, SURVEY I
HANGER 48, RANDOLPH AFB

b. Detection of Breakthrough

To detect large amounts of isocyanate which may have passed through the sampling train unreacted, trains were set-up at sampling rates of 1 and 2 Lpm, in which the sampling tube containing the nitro-coated glass fiber was followed by an impinger containing nitro/toluene reagent (Survey I). In no case was isocyanate detected in the impinger.

c. Characterization of HDI as an Aerosol/Vapor

While the sampling tube is presumably collecting all of the HDI, it is possible that if HDI exists as an aerosol, it may remain unreacted in trapped paint particles. The data in Table IV show that most of the HDI monomer detected is in the form of an aerosol. During sampling in Area A of the paint hangar (Figure I), the glass fiber sampling tubes were paired with sampling trains in which a glass fiber tube was preceded by an uncoated 37 mm glass fiber prefilter. The level of the HDI monomer detected on the single glass fiber sampling tube is 5 to 20 times greater than the level detected on the glass fiber sampling tube preceded by the prefilter.

TABLE IV. DETERMINATION OF HDI VAPOR AND AEROSOL CONCENTRATIONS, $\mu g/m^3$ (SURVEY III)

Group	Uncoated 37 mm Prefilters--Coated Fiber	Coated Fiber
1	8	62
2	4	84
3	10	73
4	13	62
5	13	66

d. Comparison of Glass Fiber Sampling Tubes and Filters

NIOSH suggests that a flat filter coated with nitro-reagent is a more efficient way to sample for aerosol. Table V shows results from paired samples using the coated glass fiber sampling tubes from Area A and closed faced cartridges with nitro-coated 37mm glass fiber filters. The sampling tubes are clearly superior with an average HDI concentration of 69 $\mu g/m^3$, compared to 23 $\mu g/m^3$ for the 37 mm filters.

TABLE V. COMPARISON OF HDI CONCENTRATIONS DETECTED ON COATED FIBER AND COATED 37 mm FILTER, $\mu g/m^3$ (SURVEY III)

Group	Coated 37 mm Filters	Coated Fiber
1	22	62
2	17	84
3	26	73
4	28	62
5	21	66

e. Comparison of Glass Fiber Sampling Tubes and Impingers

An attempt to compare the glass fiber tube and the impinger sampling methods resulted in a few data points showing no consistent, significant difference at low HDI levels (Table VI, Figure II). For longer sampling periods paint visibly collected on the walls of the impinger and at the outlet of the impinger sampling tip. The data from most of the sampling trains using toluene containing impingers were invalid because of pump failure caused by toluene leakage or because of the presence in the samples of diethylhexyl phthalate, the plasticizer in Tygon® tubing, which was dissolved by the toluene.

TABLE VI. COMPARISON OF HDI LEVELS USING NITRO-COATED GLASS FIBER SAMPLING TUBES AND TOLUENE/NITRO REAGENT IMPINGERS (SURVEY I)

	Impinger Nitro Method			TUBE NITRO METHOD		
Area	Flow Rate, Lpm	Total Volume, Liters	$\mu g/m^3$	Flow Rate, Lpm	Total Volume, Liters	$\mu g/m^3$
A1	2	170	<0.005	0.95	81	0.039
A2	2.1	178.5	0.009	1	85	0.009
A3	2.05	174.3	<0.005	1	85	0.013
A4	1.95	161.5	<0.005	0.95	81	<0.005
A5	2	73*	0.024	1	85	0.012

*Pump stopped during sampling.

B. MDI Sampling During Foam-in-Place Operations

The original intent of field testing the glass fiber sampling tube for MDI or TDI was simply to confirm the results of the NIOSH laboratory validation, which showed the method to be both accurate and precise for TDI and MDI sampling. However, the data from the foam-in-place survey at Kelly AFB do not substantiate the accuracy and precision of the method for MDI collection and suggest the need for further sampling.

During foam-in-place operations, MDI has been shown in the literature to exist normally as an aerosol, while TDI because of its higher vapor pressure, usually exists as a vapor (5). For these reasons, NIOSH validated the nitro-coated glass fiber sampling tube method for TDI vapor and used 13 mm nitro-coated glass fiber filters for MDI aerosol. However, the data collected at Kelly AFB indicate that for the conditions encountered during this particular survey, MDI existed as a vapor and that neither the glass fiber tube nor the 37 mm glass fiber filter was a satisfactory sampling method under these conditions.

The sampling trains used during the foam-in-place survey at Kelly AFB were similar to the trains set up during the spray paint surveys, in which single, nitro-coated glass fiber sampling tubes were paired with trains consisting of sampling tubes preceded by uncoated 37 mm prefilters and with single, nitro-coated 37 mm filters, all collected at 2 Lpm for 96 minutes. During the foam-in-place operation, an MDI 7005 tape monitor supplied a direct-reading, continuous strip chart recording of MDI levels.

As shown in Table VII, MDI levels on the single sampling tube do not vary significantly from the levels detected on sampling tubes preceded by an uncoated prefilter. These results indicate that MDI existed as a vapor and may explain the breakthrough evident despite the very low microgram quantities detected during the survey (Table VIII); vapor collection is generally more efficient at lower flow rates. The vapor nature of the MDI also probably explains the nondetectable MDI levels using nitro-coated 37 mm filters. The MDA 7005 tape monitor, sampling at a rate of 1.0 Lpm, over the same time period averaged 1.75 ppb MDI. If the sampling tubes were to detect MDI vapor levels of 1.75 ppb, the microgram amount of MDI present should have been approximately 3.5 micrograms, rather than the less than one-half microgram amount actually detected.

V. CONCLUSIONS

A. HDI Sampling During Aircraft Spray Painting

The data show that only 5-20% of the HDI monomer detected is in the form of free vapor with the remaining 80-95% of the reacting monomer entrapped in paint droplets. While no detectable quantities of HDI pass through the glass fiber sampling tube, it is not possible to determine in a limited field testing situation how much of the HDI present on the glass fiber is actually reacting and what effect a change in variables such as particle size distribution, sample loading, temperature, humidity, etc., would have on the accuracy of the method. Also it is not known what practical significance the

TABLE VII. MDI, µg/m³ FOAM-IN-PLACE, KELLY AFB
(SURVEY IV)

Group	Uncoated 37 mm Prefilter-Coated Fiber	Coated Fiber	Coated 37 mm Filter
1	3	ND	ND
2	2	2	ND
3	2	1	ND
4	1	3	ND

TABLE VIII. MDI, µg, FOAM-IN-PLACE, KELLY AFB
(SURVEY IV)

Group	Section	Uncoated 37 mm Prefilter-Coated Fiber	Coated Fiber	Coated 37 mm Filter
1	FRONT	0.330	0.299	
	BACK	0.208	0.157	
	TOTAL	0.538	0.456	ND
2	FRONT	0.302	0.287	
	BACK	0.096	0.139	
	TOTAL	0.398	0.426	ND
3	FRONT	0.201	0.246	
	BACK	0.200	ND	
	TOTAL	0.401	0.246	ND
4	FRONT	0.281	0.393	
	BACK	ND	0.188	
	TOTAL	0.281	0.581	ND

actual or detected levels of HDI vapor, or HDI aerosol have in terms of either toxicity or respiratory protection. Nevertheless, the method does provide reasonably precise and reproducible results in a field testing situation. It can be adapted to routine, base-level use with a minimum of difficulty. Overall, the field evaluation shows that with proper handling the glass fiber sampling tube can provide a consistent method for monitoring HDI levels during

spray paint operations up to 8.5 times the TWA and 6 times the ceiling limit at the recommended sampling volumes.

B. TDI/MDI Sampling During Foam-in-Place Operations

The results of the foam-in-place survey at Kelly AFB suggest the need for additional sampling. Future surveys should compare collection of both TDI and MDI at 1 and 2 Lpm, determine the vapor/aerosol nature of the isocyanate, and compare the efficiency of collection of sampling tubes versus flat filters for either vapor or aerosol. The MDA tape monitor method is a proven method for monitoring TDI vapor, although it requires special calibration for accurately monitoring MDI aerosol.

VI. RECOMMENDATIONS

Use of the nitro-coated glass fiber sampling tube method outlined in NIOSH Method P&CAM *326* as the best method currently available for monitoring isocyanate levels during spray painting operations.

Continued use of the MDA 7005 tape monitor when isocyanates are used in operations other than spray painting.

APPENDIX 1

MATERIAL SAFETY DATA SHEET

OMB Approval No. 45-R0138

SECTION I

MANUFACTURER'S NAME AND FSCM (Federal Supply Code for Manufacturers): DEFT CHEMICAL COATINGS 33461

EMERGENCY PHONE NO.: 714-549-8911

ADDRESS (Number, Street, City, State, and ZIP Code): 17451 Von Karman Avenue, Irvine, California 92714

CHEMICAL NAME AND SYNONYMS: Polyurethane Catalyst component

TRADE NAME AND SYNONYMS: Defthane Catalyst

CHEMICAL FAMILY: Polyurethane isocyanate catalyst

FORMULA: 03-W-40 Catalyst

FEDERAL STOCK NUMBER (FSN): 8010-00-181-8281 & 8282

GROSS WEIGHT (LBS):

OUTSIDE PACKAGE DIMENSIONS (Inches):

MIL-STD-1314/NATIONAL FIRE PROTECTION ASSOCIATION STD 704M SIGNAL

FLAMMABILITY X HEALTH ____ REACTIVITY ____ SPECIFIC HAZARD ____

SECTION II - HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, AND SOLVENTS	%	THRESHOLD LIMIT VALUE (Units)	ALLOYS AND METALLIC COATINGS	%	THRESHOLD LIMIT VALUE (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	THRESHOLD LIMIT VALUE (Units)
Methyl Ethyl Ketone	40	200
Xylene	5	100
Ethylene glycol mono ether acetate	20	100
Hexamethylene diisocyanate monomer	0.5	.02

SECTION III - PHYSICAL DATA

BOILING POINT (°F.)	175-331°F	SPECIFIC GRAVITY (H_2O=1)	.933
VAPOR PRESSURE (mm Hg.)	28.6	PERCENT VOLATILE BY VOLUME (%)	71.1
VAPOR DENSITY (AIR=1)	heavier	EVAPORATION RATE (ether =1)	slower
SOLUBILITY IN WATER	none		

APPEARANCE AND ODOR: clear thin water white organic liquid - odor of methyl ethyl ketone

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used)	FLAMMABLE LIMITS	LOWER EXPLOSIVE LIMIT	UPPER EXPLOSIVE LIMIT
28°F Tag Open Cup ASTM D 1310		1.7	not available

EXTINGUISHING MEDIA: carbon dioxide, foam or dry chemical

SPECIAL FIRE FIGHTING PROCEDURES: a self contained breathing apparatus should be worn. Do not use water stream which might spread fire. Water spray or fog.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Caution against application to hot surfaces and use in areas where sparks or open flames may be present.

DD FORM 1 JUN 71 1813

NOV 2 1977

c

SECTION V — HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE: See Section II

EFFECTS OF OVEREXPOSURE: Moderate eye irritant. Possible irritation of skin by solvents.

Irritation or narcosis can result from inhalation of solvent vapors.

EMERGENCY AND FIRST AID PROCEDURES: Skin contact - wipe off with a rag then thorough rinsing with water and washing with mild soap and water.

Eye contact - flush 10 minutes with water and consult an eye physician.

Inhalation - remove to fresh air.

SECTION VI — REACTIVITY DATA

STABILITY			CONDITIONS TO AVOID
	UNSTABLE		avoid sparks from being struck with steel object or static electricity.
	STABLE	x	Avoid open flame in vicinity. Avoid exposure to heat.

INCOMPATABILITY (Materials to avoid) - avoid contact with water, alcohols and other compounds which react with isocyanates.

HAZARDOUS DECOMPOSITION PRODUCTS

			CONDITIONS TO AVOID
HAZARDOUS POLYMERIZATION	MAY OCCUR		
	WILL NOT OCCUR	x	

SECTION VII — SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: Absorb with oil absorbing compound or dry rags. Flush with large volume of water.

WASTE DISPOSAL METHOD: Dispose in tightly closed container and finally dispose by sanitary landfill.

SECTION VIII — SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)

VENTILATION		
	LOCAL EXHAUST: use adequate ventilation with exhaust fan	SPECIAL
	MECHANICAL (General)	OTHER

PROTECTIVE GLOVES	EYE PROTECTION
yes	yes

OTHER PROTECTIVE EQUIPMENT: Use cartridge type respirator with particulate filters. (NSC Catalog No. CR84306)

SECTION IX — SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING: Material is sensitive to moisture and should be kept in tightly closed containers.

OTHER PRECAUTIONS - avoid prolonged inhalation of vapors. Where ventilation is poor a fresh air supply mask is recommended.

SECTION X — TRANS. DATA

PROPER SHIPPING (Article) NAME	DOT CLASSIFICATION
DOT ARTICLE - Paint product	Flammable liquid

DOT LABEL	DOT MARKING	EMERGENCY ACCIDENT PRECAUTIONS AND PROCEDURES
RED		Section V

DOT PLACARD	PRECAUTIONS TO BE TAKEN IN TRANSPORTATION
Flammable	Normal precautions.

U. S. GOVERNMENT PRINTING OFFICE: 1977 O - 633-33

D

MATERIAL SAFETY DATA SHEET

OMB Approval No. 45-R0338

SECTION I

MANUFACTURER'S NAME AND FSCM (Federal Supply Code for Manufacturers): DEFT CHEMICAL COATINGS 33461

EMERGENCY PHONE NO.: 714-549-8911

ADDRESS (Number, Street, City, State, and ZIP Code): 17451 Von Karman Avenue, Irvine, California 92714

CHEMICAL NAME AND SYNONYMS: Polyurethane topcoat, base component

TRADE NAME AND SYNONYMS: Defthane

CHEMICAL FAMILY: Polyurethane enamel, aliphatic

FORMULA: 03-W-40, Color 17875, MIL-C-832863

FEDERAL STOCK NUMBER (FSN): 8010-00-181-8281 & 8282

GROSS WEIGHT (LBS):

OUTSIDE PACKAGE DIMENSIONS (Inches):

MIL-STD-1314/NATIONAL FIRE PROTECTION ASSOCIATION STD 704M SIGNAL

FLAMMABILITY X HEALTH _____ REACTIVITY _____ SPECIFIC HAZARD _____

SECTION II - HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, AND SOLVENTS	%	THRESHOLD LIMIT VALUE (Units)	ALLOYS AND METALLIC COATINGS	%	THRESHOLD LIMIT VALUE (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	THRESHOLD LIMIT VALUE (Units)
Methyl ethyl ketone	10	200
Ethyl Acetate	10	400
Ethylene glycol mono ethyl ether acetate	20	100

SECTION III PHYSICAL DATA

BOILING POINT (°F.)	169-331 °F	SPECIFIC GRAVITY (H_2O=1)	1.37
VAPOR PRESSURE (mm Hg.)	15.0	PERCENT VOLATILE BY VOLUME (%)	53.44
VAPOR DENSITY (AIR = 1)	heavier	EVAPORATION RATE (ether = 1)	slower
SOLUBILITY IN WATER	none		

APPEARANCE AND ODOR: White paint, odor pleasant-pungent

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used)	FLAMMABLE LIMITS	LOWER EXPLOSIVE LIMIT	UPPER EXPLOSIVE LIMIT
28°F Open cup ASTM D 1310		1.6	not available

EXTINGUISHING MEDIA: Carbon dioxide, foam or dry chemicals

SPECIAL FIRE FIGHTING PROCEDURES: - do not use water stream which might spread fire. Water spray or fog can be used effectivcly.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Caution against application to hot surfaces and use in areas where sparks or open flames may be present

DD FORM 1 JUN 71 1813

NOV 2 1977

b

SECTION V — HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE
See Section II

EFFECTS OF OVEREXPOSURE
Moderate eye irritant. Possible irritation of skin by solvent.
Irritation or narcosis can result from inhalation of solvent vapors.

EMERGENCY AND FIRST AID PROCEDURES Skin contact - wipe off with a rag then thorough rinsing with water and washing with mild soap and water.
Eye contact - flush 10 minutes with water and consult an eye physician.
Inhalation - remove to fresh air.

SECTION VI — REACTIVITY DATA

STABILITY			CONDITIONS TO AVOID
	UNSTABLE		- avoid sparks from being struck with steel object or static electricity.
	STABLE	x	Avoid open flame in vicinity. Avoid exposure to heat.

INCOMPATABILITY (Materials to avoid)

HAZARDOUS DECOMPOSITION PRODUCTS

HAZARDOUS POLYMERIZATION			CONDITIONS TO AVOID
	MAY OCCUR		
	WILL NOT OCCUR	x	

SECTION VII — SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Absorb with oil absorbing compound or dry rags. Flush with large volume of water. Avoid sparks or open flame.

WASTE DISPOSAL METHOD
Dispose of clean-up rags by wetting with water and keep in a closed container. Dispose in tightly closed metal container and finally dispose by sanitary landfill.

SECTION VIII — SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type) Good ventilation

VENTILATION		
LOCAL EXHAUST Use adequate ventilation with exhaust fan		SPECIAL
MECHANICAL (General)		OTHER

PROTECTIVE GLOVES	EYE PROTECTION
yes	yes

OTHER PROTECTIVE EQUIPMENT

SECTION IX — SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
Use normal storing precautions as with paint. Keep away from heat, sparks or open flames.

OTHER PRECAUTIONS
Avoid prolonged inhalation of vapor.

SECTION X — TRANS. DATA

PROPER SHIPPING (Article) NAME	DOT CLASSIFICATION
DOT ARTICLE - Paint product	Flammable Liquid

DOT LABEL	DOT MARKING	EMERGENCY ACCIDENT PRECAUTIONS AND PROCEDURES
Red		See Section V

DOT PLACARD	PRECAUTIONS TO BE TAKEN IN TRANSPORTATION
Flammable	Normal precautions.

U. S. GOVERNMENT PRINTING OFFICE: 1972 O - 455-330

LITERATURE CITED

1. Birch, S.R., Industrial Hygiene Survey - 47th FMS Aircraft Painting Facility, Laughlin AFB TX, OL AA USAF OEHL, Kelly AFB TX, Report No. 77-2, March 1977.

2. Bishop, E. C., Evaluation of Aircraft Touchup Painting, Mather AFB CA, USAF OEHL Report No. 81-41, May 1981.

3. Burnett, R.D., and P. Diamond, Industrial Hygiene Evaluation of Spray Applications of Polyurethane Coatings, USAF EHL, McClellan AFB CA, Report No. 73-10, Nov 1973.

4. Criteria for Recommended Standard—Occupational Exposure to Diisocyanates, Publication No. 78-215, Rockville MD, USD (HEW), PHS, NIOSH, Sep 1978.

5. Dharmarajan V., and H. Weill, Physical State of Airborne p-p'-diphenyl methane diisocyanate (MDI) and its Measurement, Am. Ind. Hyg. Assoc. J, 39:737-44, 1978.

6. Prather, J.B., Industrial Hygiene Evaluation - Aircraft Painting Facility, Bldg 692, McClellan AFB CA, USAF OEHL Report No. 81-10, February 1981.

7. Toluene 2,4-Diisocyanate—Physical and Chemical Analysis Branch, Analytical Method No. P&CAM 326, NIOSH Manual of Analytical Methods, DHEW (NIOSH) Publication No. 80-125, Cincinnati, U.S. DHEW, PHS, CDC, NIOSH, 1980, Vol. 6, pp. 326-1/326-11.

8. Tucker, S.P., and J.E. Arnold, Sampling and Determination of 2,4-Bis(carbonylamino) toluene and 4,4-Bis(carbonylamino) diphenyl methane in Air. NIOSH, Cincinnati, Ohio, Unpublished.

9. Vogt, C.R.H., C.Y. Ko, and T.R. Ryan, Modification of an Analytical Procedure for Isocyanates to High Speed Liquid Chromatography. Cincinnati, USDHEW, PHS, CDC, NIOSH, 1976.


MEI
8